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whence they may obtain a general notion of its structure. . . . *Admission to its sanctuary and to the privileges and feelings of a votary is only to be gained by one means—sound and sufficient knowledge of mathematics, the great instrument of all exact inquiry, without which no man can ever make such advances in this or in any other of the higher departments of science as can entitle him to form an independent opinion on any subject of discussion within their range.*

SAMUEL G. BARTON

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THE LATE WILLIAM SAUNDERS, C.M.G.,  
LL.D.

IN the death of Dr. William Saunders, C.M.G., late director of the Dominion Experimental Farms, which took place at London, Ontario, on September 13, there passed away a notable pioneer in the field of Canadian agricultural investigation, one who had worked hard and successfully in the best interests of his country for more than a quarter of a century and who, we rejoice to say, had lived to see in a large measure the fruits of his labor in a very material improvement of our basic industry, in methods, in crops and in stock throughout the length and breadth of the land. Comparing the agriculture of this country to-day with that of 1886, when Dr. Saunders entered upon what we may term his life work—the establishment of the Experimental Farm System—it is abundantly apparent that farming in all its branches has developed and prospered and we can not doubt that the varied activities of this system, in research and in the wide dissemination of information among our farmers, carried forward as they have been by Dr. Saunders and his co-workers with enthusiasm and skill, must have played a very important part in this agricultural progress. It has been a valuable and national work, and stands to-day as a monument to the initiative, the unflagging zeal and the untiring energy of Dr. Saunders, who held the directorship of the farms from their establishment to April, 1911, when he retired, owing to failing health and advancing years.

William Saunders was born in Devonshire,

England, in 1836, and came at the age of 12 years to this country with his parents, who settled in London, Ontario. In early manhood he studied chemistry and pharmacy and subsequently established a business for the manufacture of pharmaceutical preparations, a business which he successfully carried on till 1886, when it was handed over to his eldest son, William E., who has remained since that date as head of the firm. In 1882, we find that his chemical knowledge had gained for him the post of public analyst for Western Ontario. Previous to that date he had taken a leading part in the founding of the Ontario College of Pharmacy, of which he was president for two years. He was also on the professoriate of the medical faculty of the Western University. His interest in entomology led him to assist in establishing the Entomological Society of Ontario, of which he was president for the period 1883–6. In the practical work of this society he maintained an active and warm interest throughout his life, acting as editor of its organ, the *Canadian Entomologist*, for thirteen years. As a result of his entomological studies, which were mainly of an economic character, he published in 1882 his work entitled "Insects Injurious to Fruit," a book that has been widely used as a text in agricultural colleges and by orchardists in the United States and Canada.

In 1868 Dr. Saunders purchased a small farm in the neighborhood of London and there, it may be said, he laid the foundation of his future work in horticulture, always his favorite study. This area of land, which he planted largely to fruit, enabled him to investigate and observe in the fields of experimental agriculture and horticulture, and no doubt furnished him with those qualities and that knowledge which led to his selection as the one best qualified to undertake the important task of establishing the Experimental Farm system. His many successes in the production of new fruits, flowers and grains during this period testify to his skill as an hybridist of the first rank.

Of his work as head of the Experimental Farms it will only be possible to give the

merest outline, but the annual reports and bulletins of that institution and his papers before learned societies give ample evidence of his active life in agricultural research. We can only refer here, and that briefly, to the results of his work with fruits and cereals.

In gooseberries he produced the Pearl and Red Jacket, both well and favorably known. With black currants he made many crosses and his Eclipse, Magnus Clipper, Climax, Success and Beauty have all established reputations. He crossed the red raspberry with the black cap, but the resulting varieties though of excellent quality and good bearers were not generally acceptable to the fruit trade by reason of their dark color. The "Sarah," however, has proved an excellent variety for home use, being valuable on account of its late fruiting. Early varieties of the red currant of Dr. Saunders's production are the Brighton and Count, both hardy, prolific and good yielders. In grapes, his Emerald, a white grape of fine quality, may be mentioned; it was held to be the best grape of the Canadian varieties exhibited at the Colonial Exhibition in London in 1886.

In ornamental plants he did excellent work, originating two fine and valuable roses, the Mary Arnott and the Agnes. Among the barberries also he left as a legacy several very interesting and highly ornamental hybrids.

His efforts and their results in hybridizing with apples are well known to the horticultural world. He set himself the difficult task of producing an apple that would be sufficiently hardy to withstand the rigor of the winter in our northwestern provinces. Many pages might be filled with an account of his labors in this direction. They were begun in 1894, using as the female parent the exceedingly hardy and exceedingly small wild Siberian crab, *Pyrus baccata*, and as the male parents a large number of hardy Russian and American apples. From these crosses he obtained his first fruit in 1899, and from among the bearing trees he found some that would justify their propagation. About 800 trees were set out and many of them have proved hardy and have fruited abundantly on the open prairie.

Their fruit showed a very considerable increase in size, as compared with that of the mother parent, some of them having a diameter of one and three quarters inches. Among these first crosses stand out the Jewel, Sylvia, Prince, Tony, Elsa and Charles. Fruit of these has been produced at Fort Vermilion, in latitude 58°, where the winter temperature may fall as low as 60° below zero Fahrenheit.

From this initial work Dr. Saunders pushed forward, seeking apples of larger size and better quality. Taking the larger, he recrossed these hybrids with several hardy apples of well-known varieties and produced a number of still greater promise. Of these second crosses he planted about 400 trees, some of which have borne fruit two and a half inches in diameter and of good quality. These are now under test on the prairie farms and it is confidently expected that many of them will prove of value where apples can not at present be successfully grown.

In his work with cereals—a work which has proved of paramount importance and value to Canada—Dr. Saunders's endeavor was to produce an early ripening wheat of good quality, that might serve for districts in the Canadian northwest where the Red Fife, our standard variety, was in some seasons injured by early autumnal frosts. The story of this wheat breeding is a long and interesting one, covering many years of patient, skilful work. Many hundreds of hybrids have been produced and tested at the Central Farm. Hundreds have been discarded in the course of this investigation and hundreds were tried out for prolificness, earliness and bread-making qualities. Of this large number a few, perhaps a dozen, have been found worthy of introduction, and these, all crosses from the standard varieties, Red Fife and White Fife, are now well known and widely cultivated. Some mention must be made of the more important of these new wheats, which are all vigorous, productive and early in ripening. Preston and Huron are bearded, the equal of Red Fife in hardness and color. Stanley is a beardless wheat and in some respects from the commercial point of view perhaps somewhat infe-

rior to the foregoing varieties. Of somewhat different parentage is the next to be referred to and the best of them all—the Marquis—derived by crossing the Red Fife with the Hard Red Calcutta. Marquis, that practically from its first introduction, leaped into popularity and stands to-day as the equal of Red Fife in bread-making qualities and vastly superior to it as regards earliness in ripening. The selection of this splendid wheat, from a number of unfixed but closely related types, is the outcome of much painstaking and careful work on the part of Dr. Saunders's third son, Dr. Charles E. Saunders, who as Dominion Cerealists at Ottawa, took up this phase of his father's work in 1903. The Marquis has more than fulfilled the most sanguine expectations, and farmers and millers alike speak most enthusiastically of its many fine qualities and its extreme earliness. It has given excellent yields in Manitoba, Saskatchewan and Alberta, but not only is it a heavy cropper, but its grain is heavy and of excellent appearance, practically undistinguishable in all good qualities for milling and baking from Red Fife. It resists well adverse weather conditions. In earliness of ripening it is ready for harvesting from 5 to 10 days before Red Fife, a matter of no small importance for districts subject to early autumnal frosts. Such a combination of good qualities easily accounts for its success with farmers and its great popularity. It is rapidly replacing all the older early maturing wheats, including the Red Fife, on our western prairies. It won the prize of \$1,000 given at the land exhibition in New York City in 1911, for the best 100 pounds of wheat grown on the continent of North America, and in 1912 was the successful competitor for the \$2,500 prize awarded by the Dry Farming Congress held in that year at Lethbridge, Alberta. In 1913 it again received the highest award at the Congress held in Tulsa, Okla. We may thus safely say that the problem that Dr. Saunders set himself, to produce a good wheat with an early maturing habit suitable for general cultivation in the Canadian northwest, has been successfully solved. The production of the Marquis

wheat has demonstrated the value of research work in agriculture and increased our possibilities as a wheat-growing country. Its value to Canada is scarcely to be calculated in thousands of dollars.

Dr. Saunders was a great lover of the beautiful in the out-of-doors, and to adorn the grounds he had charge of he introduced from other countries many shrubs and flowers. His planning and planting of the grounds and arboretum of the Central Farm and of much of the Government Driveway, at Ottawa, testify to his skill and good taste in landscape gardening.

Dr. Saunders's achievements were widely recognized. For his valuable work in promoting the interests of Canadian agriculture he was the recipient of many honors from learned societies and universities at home and abroad. He received the honorary degree of LL.D., from Queens University in 1896, and the University of Toronto bestowed on him the same honor in 1904. In 1905 he was created by His Majesty, the late King Edward VII., a Companion of the Most Distinguished Order of Saint Michael and Saint George. He was a Fellow of the American Association for the Advancement of Science, Fellow of the Linnean Society of London, Corresponding Member of the Royal Botanical Society, Fellow of the Chemical Society (London, Eng.), and held a membership in many other societies devoted to the natural sciences.

The *Transactions of the Royal Society of Canada*, of which Dr. Saunders was made a charter member on its formation in 1882, contains many contributions from his pen. The titles of some of these are "The Introduction and Dissemination of Noxious Insects," "The Importance of Economizing and Preserving Our Forests," "The Influence of Sex in the Hybridizing of Fruits," "Early Ripening Cereals," "Progress of Experiments in Cross-fertilizing at the Experimental Farms," "Results of Tree Planting on the Northwestern Plains," "Increased Production of Farm Crops by Early Sowing." These titles indicate his wide interests in economic phases of

agriculture. He was honored by election to the presidency of the Royal Society in 1906.

Dr. Saunders possessed a pleasing personality and was much beloved by those who knew him well. He was kind and considerate to all and ever ready to listen and help those who came to him for guidance and assistance. He was a good administrator, consistent, quiet and firm, with an excellent judgment of men and affairs, and these qualities no doubt contributed largely to his success as chief officer of the Experimental Farms. He never exaggerated to force home a truth, no matter how important it was, but contented himself in all his writings with a plain statement of the facts as observed and of the deductions that might safely be drawn therefrom. Anything of the spectacular or sensational, for the purpose of publicity or advertisement, were particularly abhorrent to him.

The name of Dr. Saunders is honorably and inseparably identified with the establishment and work of the Dominion Experimental Farms. To this end he labored long and earnestly and, as is well known, successfully. Canada gladly and gratefully acknowledges the benefits which those services have bestowed upon her agriculture.

FRANK T. SHUTT

*THE MUSEUM OF VERTEBRATE ZOOLOGY  
OF THE UNIVERSITY OF CALIFORNIA*

AMONG the research museums of America is one which in view of the brief period of its existence and the relatively small fund available for its maintenance has made such phenomenal growth and published such important results that it deserves the consideration and respect of all American naturalists. I refer to the Museum of Vertebrate Zoology of the University of California. This institution is only six years old, having been established in 1908 through the liberality and public spirit of Miss Annie M. Alexander. For years previously Miss Alexander had been engaged in amassing collections of West Coast mammals, and had conducted important expeditions reaching northward far into Alaska. There being at the time no museum on the Pacific coast with

which she could cooperate in building up the splendid research collections she had in view, she sought and obtained the cooperation of the State University at Berkeley. During the first year a temporary building was erected, the cost of which was shared equally by the university and Miss Alexander.

Modern work in systematic zoology has demonstrated over and over again the futility of attempting critical studies of the relations and variations of species, or of the problems of their distribution, without the illuminating aid of large series of specimens from many localities. Keenly alive to this need, Miss Alexander, by her own efforts and those of her assistants in the field, has already brought together the largest collections ever made of West Coast terrestrial vertebrates—collections sure to be of inestimable and increasing value as time goes on. Her field explorations have extended from the deserts and mountains of southern California northward and westward to Prince William Sound in Alaska. Among the areas already worked in detail are the great interior valley of California, the Colorado Desert and other deserts and mountains of southern California, Owens Valley, the Mt. Whitney region, the Trinity Mountains in northern California, Humboldt Bay on the northwest coast, the Modoc and Goose Lake region of northeast California, certain mountains and deserts in northern Nevada, Vancouver Island and other parts of British Columbia, and the Sitkan and Prince William Sound regions in Alaska.

The magnitude of the collections—consisting mainly of birds, mammals, reptiles and batrachians—is surprising in view of the relatively brief period covered by the field work, the museum already containing more than 21,000 mammals, about 25,000 birds, more than 1,300 sets of birds' eggs, and upwards of 5,500 reptiles and batrachians.

Based on these rich collections, the university has issued a series of highly important faunal and systematic papers, illustrated by plates, text-figures and maps, some treating of the faunas of special areas, others of the species of particular groups. In nearly all cases